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**PREVENTION OF CONSUMPTION.**





CLINICAL LECTURES  
ON THE  
Prevention of Consumption.

*DELIVERED AT THE WESTMINSTER HOSPITAL*  
BY  
WILLIAM MURRELL, M.D., F.R.C.P.

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## P R E F A C E.

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THESE lectures were delivered at the Westminster Hospital in November last, and were subsequently published in the *Medical Press*. They are now reproduced in book form, in the hope that they will fulfil a useful function and obtain wider publicity.

WILLIAM MURRELL.

17, WELBECK STREET,  
CAVENDISH SQUARE, LONDON.  
*February, 1895.*



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CLINICAL LECTURES  
ON THE  
PREVENTION OF CONSUMPTION.

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EVERYONE recognises in a more or less general kind of way that phthisis is one of the most important diseases with which we have to contend, and there are probably few families one or more of whose members have not been carried off by this prevalent complaint. But general impressions are not enough, and we want something more definite.

STATISTICS.

By reference to statistics we find that in England and Wales alone, in the course of 33 years from 1848 to 1880, no less than 1,702,027 deaths were classified as being due to phthisis.



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The Registrar-General says that of all the causes of death that have place in the bills of mortality this is the one which carries off the largest number of victims.

In 1892—we select this year because it is the latest concerning which we have definite information—the deaths from phthisis numbered 43,323 in England and Wales.

In addition there were 7,135 deaths from *tabes mesenterica*, and 43,323 deaths from tubercular and other *scrofulous* diseases. Moreover, 116,771 persons were registered as having died of diseases of the respiratory system, a certain proportion of these undoubtedly being of tubercular origin, although not definitely classified as such.

It may be pretty safely assumed that in the year 1892 between fifty and sixty thousand people died of phthisis in England and Wales. This year it is true was exceptional, but it was exceptional in this respect, that the death-rate from phthisis was the lowest on record.

## COMPARATIVE STATISTICS.

Figures convey little or no meaning unless they are employed for the purposes of comparison. We start on the supposition that fifty or sixty thousand people more or less die every year from consumption. Let us see how this compares with other causes of death.

There has undoubtedly of late years been a great increase in the mortality from cancer, but in 1892 the deaths from this cause numbered only 20,353, and yet this, with the exception of the preceding year, was the highest death-rate from this cause on record.

Now let us turn to the class of zymotic diseases—the specific febrile diseases—a class which includes not only influenza and enteric fever, but measles, scarlet fever, diphtheria, and diarrhoeal diseases. The deaths included in this class numbered 82,099, and yet this, again, was an exceptional record, showing an increase on the year which immediately preceded it, which itself exceeded the proportion in any year since 1884.

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The deaths from individual diseases of this class appear almost trivial when compared with the enormous number of deaths from consumption. For example, the mortality for the year from scarlet fever was 5,618, from typhoid fever 4,037, and from diphtheria 6,522.

Hydrophobia is generally regarded as a serious and even terrible disease, and yet only seven people died from it in the year.

A few other figures may be useful as a means of comparison. Accidents of all kinds are common enough, and yet we find the death-bill assignable to this cause is only a little over 16,000. The deaths from railway accidents alone are a little under 1,000. The suicides number 2,583, whilst the deaths ascribed to homicide are 300; the verdict in 138 cases being manslaughter, and in 162 murder. In respect of the 162 murders, only 16 people were executed.

Turning to an exceptional cause of death, we note that the mortality from influenza in the three years 1890-91-92 was 110,000 at the very least. Great as it was, it is probable that it was

less than the mortality from phthisis and other tubercular diseases for the same period.

As another means of indicating the importance of consumption, it may be noted that according to the Registrar-General's report one person in every eight in this country dies from phthisis.

#### THE DISQUALIFYING POWER OF CONSUMPTION.

A disease is serious, not only from the number of people it kills, but from its power of curtailing the usefulness of those who are living, either in their earning capacity or in their capacity for enjoying life. We can work this out in only one way, and that is by endeavouring to form some estimate of the duration of life of the phthisical patient. Many of them undoubtedly die within the first six months, and from this point of view hardly affect the question. But in others life is prolonged not only for months, but for a long series of years. Pollock gives from  $2\frac{3}{4}$  to 3 years as the average duration of 129 cases ending in death out of 3,566 patients. These were hospital

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out-patients, and only those cases were included which terminated fatally. Hospital out-patients suffering from consumption are notoriously bad lives, and these figures do not settle the question of the average duration of phthisis for two reasons—first, because the hospital out-patient is by no means an average patient ; and, secondly, because the patients who were still alive at the conclusion of the period of observation may have lived many years longer, so as to bring up the average of life of the 3,566 patients very materially. Williams gives  $7\frac{1}{2}$  years as the duration of life of 198 consumptives out of a thousand, but these were private patients, many of them in all probability living in exceptionally favourable circumstances, and again there is the same fallacy in the absence of the life-history of the whole of the number. Still, if we combine Pollock's  $2\frac{3}{4}$  to 3 year patients with Williams'  $7\frac{1}{2}$  year patients we arrive at some kind of rough idea that patients suffering from this disease remain with us, on the average, for something like five years before they are carried off. We are probably not far wrong in assuming

that in England and Wales at this moment there are from 150,000 to 200,000 people suffering from the disease. It is possible that many of these are in the full exercise of their powers, and that their earning capacity is unimpaired, but the majority are in all probability simply burdens on their relatives, or are inmates of hospitals or other charitable institutions. Many of them must be married, and are helping to swell the enormous number of children who are annually brought into the world suffering from the hereditary taint of consumption. In addition to the 150,000 persons suffering actively from consumption, we must add the large number of cured cases, and those who from hereditary taint and other causes are especially susceptible to the disease.

With the view of arriving at some definite conclusion respecting the best methods of preventing phthisis, it becomes necessary to investigate carefully the causes, both predisposing and exciting, of this malady.

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### THE CONTAGIOUSNESS OF PHTHISIS.

There can be no doubt that, under certain circumstances, consumption is a communicable disease. The evidence in support of this view is partly clinical and partly experimental. The term 'contagious' is vague and ill defined, and, with regard to phthisis, must be held to be identical with the word 'communicable.' Scarlet fever, typhoid fever, and syphilis are all communicable diseases, but they are contagious to a very different degree. Until comparatively recently, phthisis was not generally regarded as a communicable disease, although little by little the view has gained ground that it is contagious to a very marked extent. In some parts of Germany phthisis is considered to be almost as infectious as the zymotic diseases, and in their hospitals cases of pulmonary tuberculosis are treated, not in the general wards, but in the fever wards together with patients suffering from scarlet fever and other acute infectious disorders. In German prisons, when a prisoner is found to be consump-

tive, he is at once isolated, and an elaborate process of disinfection is resorted to in order to prevent the cell from becoming a centre of infection. In Italy consumption has long been regarded as a contagious disease, and when anyone dies of this complaint, the bed and all the clothes of the deceased are destroyed, and the room, after being thoroughly cleaned and disinfected, is shut up, and is not again occupied for some time. Dr. Gaston, of Rome, says: 'The greatest terror exists amongst the poor as to the communicability of the disease.' At the Hospital of St. John Lateran there is an upper ward reserved exclusively for consumptive patients, who are not admitted into the general wards.

For many years I have been strongly of opinion that phthisis is a disease which may be communicated. In the *Lancet* of May 22, 1880, I published a case which bears on this point. The patient, a young woman, æt. 26, came of a perfectly healthy stock, there being no evidence of phthisis in her family. She married a consumptive husband, and nursed him day and night



until the time of his death, which occurred nine months later. During his long illness he expectorated profusely, and the couple were shut up in a small bedroom, in which a fire was constantly burning. Soon after his death she developed symptoms of phthisis, and on examination was found to have crepitation at the apices of both lungs. Dr. Reginald Thompson, in an article on the 'Infection of Phthisis' (*Lancet*, November 6, 1880), records fifteen well-marked cases in which the disease was apparently communicated from one person to another. He points out that the cases to which especial attention should be directed are those of wives infected by husbands, 'inasmuch as the possibility of error arising from blood relationship is hereby avoided, and the association of the nursing wife with the sick husband is so constant and intimate that, if phthisis can be communicated, it must be looked for in such instances.' A wife is more likely to contract phthisis from her husband than the husband is from his wife, for her duties confine her to the sick-room, whilst, if the wife is ill, the

husband rarely nurses her, but is out looking after his business, and endeavouring to keep pace with the increased demands on his purse entailed by the fact that there is illness in the house.

Dr. Hermann Weber, in vol. vii. of the 'Transactions of the Clinical Society,' contributes an interesting article on 'The Communicability of Consumption from Husband to Wife.' He gives the history of 68 persons, male or female, who, with a more or less pronounced consumptive taint, married healthy partners. The wives of 39 husbands became affected, and the husbands in more than one instance infected more than one wife. Thus, 9 husbands lost between them 18 wives in this way—1 having lost 4 wives, 1 losing 3, 4 others 2 each, and 3 only 1 each. The husbands who married consumptive wives suffered less, for of the husbands of 29 wives, only 1 was infected. Dr. Weber, writing nine years later, stated that he had observed two additional cases, and that his conviction of the communicability of phthisis had increased.

The Collective Investigation Committee of the

British Medical Association in 1883 instituted an inquiry into the communicability of phthisis, and from their report ('The Collective Investigation Record,' vol. i.) it appears that out of 1,078 members of the association who returned answers to the questions, 261 had seen cases of phthisis which they believed had originated in communication from one person to another, and 39 more had seen cases in which they had reason to suppose that phthisis was so communicated. In 119 of these cases the disease was transmitted from husband to wife, and in 69 from wife to husband. The investigation was in every way a most interesting one, and resulted in the accumulation of a number of facts, the importance of which cannot be over-estimated. Dr. C. T. Williams ('Pulmonary Consumption,' 1887, p. 87), referring to the investigation, says: 'It is much to be regretted that this interesting collection of answers should be prefaced by a report which does not do justice to the evidence, and is more remarkable for a bias towards the infection theory than for a calm examination of the accu-

culated facts.' The report in question was prepared by Dr. Burney Yeo, and seems to me to be a perfectly fair one.

The evidence as to the possibility of communicating phthisis between people who are not in the relation of man and wife is less conclusive, but still there is a good deal of testimony on this point. In one case a healthy man, æt. 22, with no family predisposition to phthisis, went on a visit to the seaside, and slept with a young man who was suffering from this disease. He apparently contracted the complaint from him, and he died from it a few months later. In another case, an apprentice slept with his phthisical master, and soon after developed symptoms of the disease, from which he died. In still another case, a lady æt. 28, who had lost her parents and six brothers and sisters by consumption, accepted a situation as governess in a family with an excellent health record. One daughter, who was much attached to this governess, slept in the same room, and from time to time in the same bed with her, and never left her till she died. This young lady

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became tuberculous, and died of the complaint a couple of years later. This and many similar cases are recorded in the report of the Collective Investigation Committee.

A remarkable instance of the communicability of consumption is recorded by Bergeret. He relates the case of a soldier, healthy and without hereditary taint, who, suffering from a trivial ailment, was sent to a hospital. By chance he was placed in the ward between two consumptive patients. He speedily developed symptoms of the disease, and was sent home to his native place. Shortly after, his mother, two brothers, and a neighbour and his wife became consumptive.

These examples may be exceptional, but there are probably few medical men whose attention has been drawn to the subject who have not met with similar instances. It must be remembered that until comparatively recently consumption was so generally held to be non-contagious—in this country at all events—that when a death occurred under suspicious circumstances it was

usually regarded as a curious coincidence not worth recording. The negative evidence as to the communicability of phthisis is numerically strong, but in other respects is weak. Thus, out of 1,078 returns recorded by the Collective Investigation Committee, 673 reporters had never met with any case in which they had reason for supposing that phthisis had been communicated. This probably amounts to very little, for unless attention is directed to a subject it readily passes unnoticed. Even in the case of well-marked contagious diseases, such as scarlet fever, many people escape after being exposed to infection. Many medical men, for example, are brought intimately in contact with infectious diseases of all kinds day after day, and year after year, and yet fail to contract them.

It must be remembered that phthisis is more likely to be communicated amongst the poor, with whom accommodation is limited, than amongst the well-to-do, who have the enormous advantage of large and well-ventilated rooms.

### THE BROMPTON STATISTICS.

There are two papers which are constantly quoted as affording evidence of the non-contagiousness of phthisis. They are both on the same lines, and deal with the statistics of the Hospital for Consumption at Brompton. The first is by Dr. Cotton, and the second, published some fifteen years later, is by Dr. C. T. Williams.

Dr. Cotton, in the *Lancet* of November 2, 1867, published a paper on the 'Nature and Mode of Propagation of Phthisis,' in which he endeavoured to show, as the result of his experience at the Hospital for Consumption, that phthisis is a disease 'incapable of being communicated by one person to another in the ordinary sense of a contagious disease.' This article is by no means convincing, and is certainly not worthy of the importance usually attached to it. It ignores completely the possibility of phthisis being communicated from husband to wife, and *vice versâ*. A startling commentary on this paper is furnished by Dr. Frederick E. Webb, who, in a communi-

cation to the Collective Investigation Committee, criticising the statement that Dr. Cotton did not hold the doctrine of the communicability of phthisis pulmonalis, says: 'When attending a patient with me the year before he died, he decidedly expressed an opposite view. The patient, a girl the same age as one of my daughters, and a dear friend of hers, had scrofulous parents, and Dr. Cotton advised me on no account to permit my own child to visit her dying friend.' Dr. Cotton's article appears to have been written hurriedly, and in reply to a previous communication on the same subject, and I am not surprised to find that further consideration induced him to modify his views.

In the *British Medical Journal* of September 30, 1882, there is an article on the contagion of phthisis by Dr. C. T. Williams, evidently suggested by Dr. Cotton's paper, in which he, too, endeavours to prove by the statistics of the Hospital for Consumption that phthisis is not a communicable disease. From his figures it appears that of four resident medical officers, six



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matrons and four chaplains, none of them contracted chest disease. I do not think that these figures prove much, for, if I mistake not, the chaplain is a non-resident officer, living in a large and comfortable house at some distance from the hospital. The resident medical officer lives in the hospital, but has his own suite of apartments, which are cut off from the rest of the establishment. For many years the incumbent of that office was practically a purely executive official who had little or nothing to do with the treatment of the patients, except in the comparatively rare event of sudden and dangerous hæmoptysis. It is somewhat remarkable that, of the nine secretaries and clerks, three are stated to have been threatened with lung disease. I do not know to what extent they were brought in actual contact with the patients, but probably the clerks were from time to time employed in the out-patient department in sorting and distributing the letters. Of the twenty-two dispensers, six contracted phthisis. The officials in this department are non-resident, and have no duties in the wards,

but the dispensary in the old building ventilated directly into the overcrowded out-patient department. Of the 150 clinical assistants, 12 per cent. seem to have contracted diseases of the chest. This is about the average death rate for the whole country, but it is a high average when it is considered that the occupants of these posts were carefully selected from a fairly large number of candidates, that they held office for only six months, and that a man with a phthisical tendency, guided as he naturally would be by the advice of one or more of the staff of the hospital at which he received his medical education, would hardly be likely to apply for that particular post. The clinical assistants were in this sense picked men, yet they exhibited no special immunity from the disease. The statistics respecting the life-history of the nurses seem to be incomplete, and it is difficult to make out from the article in question what proportion of them suffered from chest diseases. I am not altogether surprised at this, and from certain facts which have come to my knowledge, I am inclined to think that many

nurses when they were ill consulted their own medical advisers in preference to those who were officially connected with them. It was so contrary to the traditions of the place that they could contract chest mischief that they would not readily confess that they had done so. From a careful perusal of Dr. Williams' interesting paper, I do not think that he has proved his contention, that at the Hospital for Consumption the disease is not communicable, and the high rate of mortality amongst the dispensers is rather evidence to the contrary.

In a recent discussion on the influence of heredity in phthisis at the Royal Medico-Chirurgical Society, Dr. Pollock, referring to the Hospital for Consumption, is reported to have said: 'We have only lost three persons belonging to the staff in fifty years, and two of these were phthisical when they entered.' This is striking testimony, but the weak point is that we do not know exactly what Dr. Pollock means by the term 'staff.' In all probability he refers only to the permanent medical staff of the hospital—that

is to say, the six physicians and six assistant physicians—and does not include the resident medical officer and the clinical assistants. It certainly cannot apply to the nurses and dispensers. The term 'lost' is also somewhat vague, and probably means 'died whilst in office.' It may be that Dr. Pollock, who is a model of accuracy, defined these expressions in his speech, but as I have only the newspaper report to guide me, I am perhaps trespassing on somewhat uncertain ground.

#### EXPERIMENTAL EVIDENCE.

Many experiments have been made of late years, especially since the discovery of the tubercle bacillus, with the view of testing the contagiousness of consumption. One of the most exhaustive of these investigations was undertaken by Dr. Cornet, whose conclusions were published in the *Zeitschrift für Hygiene*. He examined the dust of rooms recently inhabited by phthisical patients. The dust was collected from the neighbourhood of the patients' beds, but at such a distance

from them that it could not have been contaminated either by direct contact with the patients or their expectoration. A definite quantity of this dust was introduced into the bodies of guinea-pigs to test its powers of infection. The experiments made were very numerous, nearly four hundred animals being used for the purpose. Of these as nearly as possible one half died from acute infection, whilst a large proportion succumbed to peritonitis, the proportion varying according to the source from which the dust was obtained. It was found that the virus of the tubercle was by no means widely distributed, and that it was concentrated in the vicinity of patients suffering from the disease. As long as the sputum remained moist it was practically harmless, for it was only when it became dry that it was wafted about in the surrounding atmosphere. It was found that one of the most certain ways of disseminating it was to expectorate into a handkerchief and then allow it to dry. The dust of a room which has been inhabited by a person suffering from phthisis is a source of danger to other people when inhaled, especially

when they are predisposed to the disease. But it is only the dry sputum which is dangerous.

Every sufferer from consumption should expectorate into a spittoon containing a disinfectant solution, and should not be allowed to spit on the floor or into a handkerchief. The exact form of spittoon employed is not a matter of much importance, but an excellent spittoon cup has been devised, consisting of a metal framework into which fits a stiff and waterproof paper case shaped like an ordinary spittoon. The cups are readily replaced, and with their contents should be burnt when once they have been used. The best disinfectant to employ is the Local Government Board solution, which is prepared as required for use by dissolving one of the 'L.G.B.' solids in water. The sputum is rendered innocuous, and can do no further harm. The necessity for disinfecting the expectoration of phthisical patients seems to be hardly sufficiently recognised even in hospital practice, for in a paper published by Dr. C. T. Williams in 1882 he says: 'The spittoons of the patients are changed two or three times a day;

but until lately, unless the odour was unpleasant, no attempt was made to disinfect them.' In hospitals the best way of getting rid of it is to mix it with fine coal and burn it in the furnace.

When handkerchiefs are used, as they sometimes are in travelling, they should not be allowed to dry, but should be thrown into a pail containing the 'L.G.B.' solution. At the end of the week they should be scalded, and then washed.

There is reason to believe that the ordinary methods of disinfecting bedding which has been used by consumptives is not efficacious. Cornet procured an old feather bed, and after extracting from it one hundred feathers, infected each with the tubercle bacillus. Replacing them amongst the other feathers, he sent the bed to be disinfected in the ordinary way. He then abstracted five of the infected feathers, which he had carefully marked, and inoculated with them a number of guinea-pigs, producing in each case an attack of tuberculosis. This experiment was repeated six times, and always with the same result. It is obvious that it is not sufficient to disinfect the

bedding of a phthisical patient in its entirety, but that it should be taken to pieces before being submitted to the process.

In summer, and during warm weather, the phthisical sputum on clothes and on the ground is more quickly dried, and more readily converted into dust, but during the winter months, when bronchitis is prevalent, the epithelial coverings of the air passages are desquamated and offer more favourable opportunities for the inoculation of tubercular matter.

#### EXCEPTIONAL SOURCES OF CONTAGION.

That the study of bacteriology is not unattended with danger is shown by the fact that, according to recent reports, Dr. John M. Byron, the well-known bacteriologist of New York, and director of the Bacteriological Department of the Loomis Laboratory, has contracted pulmonary tuberculosis whilst pursuing a course of investigations on Koch's bacillus. Dr. Charles Graham, bacteriologist to the Starling Medical College at Columbus'



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Ohio, is said to have become infected in a similar manner.

There seems to be good reason for supposing that wind instruments may sometimes be the mode of conveying consumption. A soldier who borrowed a bugle belonging to a musician who was suffering from tuberculosis fell a victim to the disease.

Dr. Maljean poured a little sterilized water into a trumpet which had been used by a consumptive patient, and shook it up for ten minutes. The water, after standing for twenty-four hours, was found to contain a deposit which separated into two layers. The lower stratum, which was dark in colour, consisted chiefly of dust. The upper stratum was thick and white, and this was decanted and filtered through fine linen. Two cubic centimetres were injected under the skin of the abdomen of a guinea-pig. Thirty-three days later the animal was killed, and tubercle was found in the spleen. Other guinea-pigs inoculated from this one died, and were found to be tubercular:

A wind instrument is safe so long as it is moist

inside, but if it is put by and allowed to become dry there is a very appreciable danger in using it if it has been played on by a phthysical person. Probably the safest plan would be to fill it with a five per cent. solution of carbolic acid, or, in the case of a metal instrument, to dip it for a moment into boiling water.

There seems to be some reason for supposing that under certain circumstances the Communion-cup may be the medium of conveying communicable diseases. The subject was fully discussed by the Rochester (N. Y.) Pathological Society, which passed a series of resolutions on the subject. Dr. Charles Forbes, the Sanitary Inspector of the United States Marine Hospital Service, advocates the use of individual Communion-cups, and these are now commonly employed in the churches in the States.

In connection with the subject of the contagiousness of phthisis, it may be as well to point out the risk to which healthy people are not infrequently exposed from consumptive fellow-travellers, especially on board ship. It has long

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been the custom for medical men in this country to send their phthisical patients for a voyage to Australia, a sailing vessel not infrequently being selected for this purpose. The position of a traveller who finds himself condemned to pass several weeks cooped up in a small cabin with a passenger in the last stage of consumption is by no means an enviable one, especially when the vessel is crowded and there is no possibility of finding other accommodation. The invalid naturally enough passes most of his time in his berth, and displays a considerable dread of anything like efficient ventilation. The only course open to the victim of this unfortunate combination of circumstances is to insist firmly on the patient being removed to the ship's hospital. When a passenger is suffering from phthisis, that fact should be notified to the authorities at the time of taking the passage, and should this precaution be neglected, the captain should have power, on the advice of the ship's surgeon, to refuse so dangerous a person, or to put him ashore at the first convenient opportunity. Consumptive

patients should be assigned cabins to themselves, either separately or in common, and steps should be taken to see that their expectoration is disinfected. At the end of the voyage the whole of the fittings should be removed, and the cabin itself should be thoroughly fumigated before being occupied by another passenger.

The following case, recorded by a physician in the *British Medical Journal* of January 6, 1883, affords a striking example of the danger to which I have referred : ‘ A lady, about thirty years of age, the wife of an army officer, left Calcutta with her husband to go by sea to Southampton. At the time of leaving Calcutta she was in robust health, whilst he was in an advanced stage of consumption. They had a single close cabin, and she performed all the duties of a nurse for her husband. The weather was stormy, and they were more than once battened down. The husband died off the Cape, and was buried at sea. Soon after the lady landed at Southampton I was asked to see her professionally. I found her with both lungs stuffed with tubercle, and she died about six

weeks after. The painful duty devolved on me of acquainting her with her condition, when she exclaimed : "Impossible ! I was never better in my life than when I stepped on board at Calcutta." I knew the lady well, and all her family, and there was no hereditary predisposition. In this case all the necessary conditions for the propagation of the disease were fulfilled—a high temperature in a close ill-ventilated cabin, where the exhalations from the diseased lungs were inhaled by the sound lungs, with the well-nigh inevitable result I have described.

A closely analogous case is recorded by Dr. Henry Bennett (*British Medical Journal* of October 11, 1884). The patient was 'a young healthy officer, who came from New Zealand with his wife, the latter in advanced decline. She had large cavities in her lungs, and spat, he told me, immense quantities of matter. They lived together in a small cabin, only a few feet square, day and night, with the window generally shut, for four months, and she died a few days after landing in England. A short time afterwards he

showed signs of pulmonary consumption, which drove him to Mentone the following winter.' We are told that there were no consumptive antecedents in the family. This looks like a pretty conclusive case, but for all that Dr. Henry Bennett is not a supporter of the theory of the contagiousness of consumption.

It is probable that many of these cases of infective phthisis are often mistaken for typhoid fever. They are of the type described by Landouzy under the term '*fièvre bacillaire pré-tuberculeuse à forme typhoïde*.'

My attention has been called by a patient to the fact that there must be a certain amount of risk to people predisposed to phthisis who travel in the sleeping-carriages on certain lines at that particular period of the year when consumptives migrate in large numbers to the Riviera and other fashionable health resorts. It would be satisfactory to learn that some steps were taken at the completion of each journey to have the sleeping apartments thoroughly aired and washed with some efficient disinfectant. This is by no

means a trivial matter, and passengers who are willing to pay well for good accommodation would receive with feelings of satisfaction an assurance that their health was the first consideration.

Again, in many of our high-altitude health resorts the atmosphere of the public rooms, especially during a spell of bad weather, is not all that could be desired. The visitors, most of whom are suffering from some form of lung complaint, are often unable to get out for days together, and as the place is warmed by stoves, and every breath of fresh air is religiously excluded, it seems probable that in many cases more harm than good is done.

The omnibuses in London and other large towns which ply on the routes leading to and from the various hospitals for consumption have been described as veritable death-traps. The patients expectorate into the straw, and when the fine weather comes, every passenger on his entrance and exit raises a cloud of dust laden with the bacillus of tubercle.

It may be that these fears are exaggerated, but the subject is certainly worthy of consideration.

#### THE INOCULATION OF TUBERCLE.

There is no doubt that tubercular disease can be inoculated. The credit of first inducing tuberculosis experimentally is due to Klencke, who in 1843 made a series of observations on the subject. His work attracted but little attention, and in 1865 Villemin published a series of carefully planned experiments bearing on this question. Chauveau obtained similar results, although they differed somewhat in matters of detail. Koch showed that the results of inoculation of animals with tuberculous matter were always the same. The inoculation method, when guinea-pigs are employed, gives results free from any trace of ambiguity. The positive results are more decisive than the discovery of the bacillus tuberculosis, whilst the negative indications are almost as valuable as the positive.

In some of Koch's experiments the sputum of



tuberculous patients was allowed to dry in much the same way as expectoration may constantly be seen drying on the pavement of the streets and on the floors of places of public resort, and when injected into guinea-pigs and other animals was found to induce the disease with absolute certainty, no matter whether the sputum had been kept only a couple of days or as many months.

Sometimes the inoculation occurs accidentally. The following case is recorded in detail in the '*Annales de Dermatologie et de Syphilographie*,' vol. vi. :—A servant girl nursed her master, who suffered from phthisis and expectorated freely. A few days before his death the glass vessel into which he was accustomed to spit was accidentally broken, and she pricked her finger with one of the fragments. A tumour formed, and was removed by operation. Under the microscope the diseased tissues were found studded with typical tubercle, with caseous centres, and giant cells. In these giant cells and around the caseous material tubercle bacilli were found.

The case is recorded of a medical student who pricked his finger whilst performing a post-mortem examination on the body of a man who died of consumption. The wound, which was on the finger, speedily assumed the appearance of a tubercular growth. The fungoid mass was excised, and an examination of the diseased tissue disclosed the usual evidences of tubercular growth.

A healthy woman, æt. 44, was accidentally bitten in the lip by her consumptive husband, and the wound became tubercular in character.

A curious case is recorded of the transmission of tubercle to a healthy girl of fourteen by means of earrings which had belonged to a person who died of consumption.

Many other instances might be given, but these may be regarded as typical.

Tappenier, Bertheau, Weichselbaum of Vienna, and other investigators, have shown that the disease may be produced in dogs and some other animals by the inhalation of the atomized sputa of tubercular patients. Of eleven dogs subjected

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to experiment, all, with one doubtful exception, presented miliary tubercles in the lungs. Schottelius goes further than this, and claims that he produces similar nodules in the lungs of dogs by the inhalation of various organic substances, such as the sputum of non-tubercular persons, cerebral tissue, and even cheese. Bertheau confirms the statements of Tappenier, but not those of Schottelius. One thing is clear, and that is that tubercular sputum contains a virus which, in whatever quantity or in whatever mode it is introduced into the organism, produces without exception nodules which have the structure of tubercle.

In most cases of phthisis the sputum contains tubercle bacilli, often in great numbers, and usually in the spore-bearing condition. These spores retain their vitality, and under suitable conditions are capable of growing and producing tubercle bacilli for a period of at least three months, and probably very much longer.

Sormani and Brugnattelli of Pavia, in their '*Ricerche Sperimentali sui Neutralizzanti del*

*Bacillo Tubercolare*, have shown by injections on guinea-pigs that the activity of the bacilli contained in phthisical sputum can be destroyed by certain drugs, and they arrange the neutralizing power of the medicaments employed in the following order, the most active being placed first on the list: Perchloride of mercury, phenic acid, *a* naphthol, creosote, chloride of palladium, turpentine, *β* naphthol, bromide of ethyl, saturated solution of camphor, saturated solution of camphoric acid, and, lastly, lactic acid.

Amongst the curiosities of inoculation, reference may be made to a case recorded by Raymond of a phthisical patient who infected a small wound on his own hand by sucking it.

It is an undoubted fact that phthisis of late years has become much more common amongst the girls and young women at Mentone, especially amongst the washerwomen, who constitute a numerous class, and there is reason to believe that in many cases contagion has arisen from washing the linen soiled by the sputa of consumptive patients.

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It may be as well to mention in connection with the subject of the inoculation of consumption that there is no reason to suppose that tubercular disease can be conveyed through the agency of vaccination. Chauveau, Meyer, and other well-known observers, deny the possibility of infection from this source, and Strauss reports that in twenty vaccinations made from phthisical individuals to healthy animals no tuberculosis ensued. Still, as a matter of precaution, vaccination should never be performed from persons who are known or suspected to be tubercular.

### TUBERCLE FROM THE LOWER ANIMALS.

There can be no doubt that tubercular disease is constantly communicated from the lower animals to man. It is now generally recognised that any part of the body of a tuberculous animal, or any secretion of such an animal, would, if it contained tubercle bacilli, be a source of danger, and that its use as an article of diet should be avoided and prohibited. Questions relating to

infection by meat, and by the milk of tuberculous cows, have been largely discussed, especially since the Congress on Tuberculosis held in Paris in 1888. Under certain conditions the virus of tubercle is absorbed by the small intestine in man. We have a good illustration of this in what occurs in any ordinary case of phthisis. The expectoration when swallowed produces no effect on the œsophagus or on the stomach, for it passes through the former too quickly to do any harm, whilst in the latter the mucous membrane is effectually protected by the gastric juice. In the alkaline contents of the small intestine it meets with a condition favourable to its development, and, being absorbed, gives rise to the ulcerated condition with which we are so familiar in advanced cases of phthisis. It has been computed that 40 per cent. of the children who die in our hospitals die of tubercular disease, and there is every reason to believe that much of this mortality is due to the use of milk obtained from tubercular cows. It is probably not in every case that infection occurs, but when there is a heredi-

tary predisposition to the disease the risk is enormously increased.

Animals of all kinds have been fed experimentally on tubercular meat, and in some cases the juice expressed from tubercular meat has been injected beneath the skin. The experiments have been checked and varied in every possible way, but the result has always been the same. Some of the animals escaped infection, but the majority either died of tubercular disease, or, if they were killed, showed post-mortem evidence of being tubercular. When, however, the tubercular meat was thoroughly roasted or boiled before being administered, the disease was not communicated. Underdone meat, on the other hand, afforded no protection, and in the great majority of cases the animals became tubercular. A suggestive case is recorded by De Lumalleree. A soldier returned home consumptive after undergoing confinement in a Prussian military prison. Previous to his return no one in the village had for many years suffered from consumption. He expectorated freely, and it was observed that the

fowls swallowed the expectorated matter. These fowls were given to a woman in the village who was in perfect health, and in the course of four months she consumed sixteen of them. She had no direct communication with the patient, but after a time became consumptive. One of the fowls was killed and examined, and tubercle was found in the liver and other organs.

The immunity of Jews from consumption is ascribed to the great care exercised by them in rejecting the flesh of all animals infected with tubercular disease. All the internal organs of the animal are most carefully examined, and the lungs are submitted to most minute scrutiny. If any tubercle is detected in the lung, the whole carcase is rejected.

Most authorities agree that the flesh of a tubercular cow, even when the disease is localized in the lungs, should not be eaten by man. There is also a pretty general consensus of opinion that when the tuberculosis is general there is danger of specific infection, not only from eating the flesh, but also from drinking the milk of the



infected animal. To this may be added that, when there is tuberculosis of the udders, the specific infection will very probably be transmitted through the milk. Butter, too, may be the vehicle of tuberculous infection. Roth of Zurich examined twenty samples of butter made from cows' milk, and bought in different Swiss markets, and found that two of them contained tubercle bacilli, which, when injected into guinea-pigs, produced tuberculosis in those animals. Dr. Brusa Ferro made a similar series of experiments with Italian butters, and found that 10 per cent. of them conveyed tuberculous infection.

As an indication that the subject of tuberculosis amongst cattle is attracting some attention, it may be mentioned that a Royal Commission has been appointed to consider what is the effect, if any, on human health of food derived from tuberculous animals, and, if prejudicial, what are the circumstances and conditions with regard to tuberculosis in the animal which produce that effect upon man. We are told that the Commission previously appointed by royal warrant

of July 21, 1890, is revoked and determined in favour of the present inquiry.

#### THE OVERCROWDING OF CATTLE.

There is no doubt that cattle often become tubercular from overcrowding and from being improperly housed. The amount of cubic space allotted to each animal might advantageously be regulated by legislation. Attention to space and ventilation in the sheds, combined with the early isolation of suspected animals, would do much towards stamping out tuberculosis. The subject is a very important one: it is of importance to parents who see themselves and their children threatened with the national plague, to the butcher who begins to realize the fact that it is unsafe to sell tuberculous meat, and to farmers and cattle-breeders who are liable to have their cattle condemned on hygienic grounds. The matter is attracting the attention of veterinary surgeons, who are often called on to give an opinion respecting the health of particular animals.

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The importance of inspecting meat exposed for sale and of carcasses recently slaughtered is obvious. It may be said that persons properly qualified to undertake this duty are not readily found, but if the work were remunerative, the supply of skilled inspectors would soon equal the demand.

#### KOCH'S TUBERCULIN NOT A FAILURE.

Although Koch's tuberculin has not answered the expectations which were formed of it from a therapeutical point of view, there can be no doubt as to its value as a diagnostic agent. The prevalence of tuberculosis amongst animals both in Canada and in the United States has led to the imposition of a series of stringent regulations respecting the importation of cattle. The New York Legislature has provided for the appointment of three inspectors whose duty it is to examine the herds in each district and have the affected cattle killed. In the first place a physical examination is made, and if there is reason for suspecting the existence of tuberculosis, an injec-

tion of tuberculin is given. If after the injection the temperature rises markedly, this is considered sufficient evidence, and the animal is forthwith killed. A post-mortem examination is made, and a report embodying the results is sent to the State Board of Health. In the course of a year the three inspectors examined 20,000 animals, and of these 686 were found to be infected, and were killed. The Danish Government have been equally energetic, and have granted their chief veterinary adviser the sum of £3,000, which will be renewed annually for five years, to enable him and his staff to carry out a systematic inspection of all cows not previously under observation ; to use tuberculin as a diagnostic agent, and to kill off the cattle which are affected with tuberculosis. Dr. Sims Woodhead, commenting on this new department, says : ' It is hoped in this manner to stamp out the disease in the present generation, and I am convinced that if this once be thoroughly done, and the inspection be continued, the comparatively trifling amount spent by the Government will prevent a loss to the Danish farmers,

and will cause a gain to infant life almost incalculable.' Professor McFadyean, in an introductory address on the contagious diseases of animals, delivered at the Royal Veterinary College of London, pointed out that the discovery of tuberculin had put into the hands of veterinary surgeons a weapon by means of which anyone might free his own stock from tuberculosis at a cost which would be small compared with the steady loss entailed by the present neglect of every reasonable precaution against the spread of the disease. The eradication of animal tuberculosis would be a great national gain, and would be indirectly useful in convincing the public that contagion is the main factor in the dissemination of phthisis.

That tubercle can be conveyed from one animal to another without direct inoculation seems to be proved by an experimental inquiry conducted by Koch. He procured a hundred guinea-pigs, all of which were healthy. Several of them were shut up in a room with other guinea-pigs which had been inoculated with the virus of tubercle. After the lapse of some months the previously

healthy guinea-pigs became tubercular. Presuming that there was no overcrowding, and that the production of tubercle was not due to confinement, this would indicate that the disease may be communicated from one animal to another, a point of no small importance with reference to the necessity for promptly isolating infected cattle.

There are one or two practical points which may be emphasized in connection with this particular phase of the question. In the first place, all milk used in the household should be boiled, especially when there is a family predisposition to phthisis. Secondly, meat should be thoroughly cooked. When meat is roasted, the central portions are not as fully exposed to the action of heat as the outer portions. In order to destroy the bacilli in infected meat, it is necessary that the temperature of every portion should be maintained at at least 158° F. (70° C.) for an hour. Even then it had better not be eaten. Finally, raw meat should be avoided. Many physicians in cases of wasting diseases recommend that milk should be consumed in large quantities, and they sometimes

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in addition suggest the use of raw beef in the form of sandwiches. The treatment has indubitably many advantages, but care should be taken that the very means designed with the view of warding off consumption are not made the instrument of introducing it into the system.

It has been suggested that the milk of tubercular cattle should not be wasted, but should be given to the pigs to fatten them. This is a very dangerous proceeding, and infected milk should not be employed for this purpose—certainly not until after very thorough boiling.

### SOIL AND DRAINAGE.

Soil and drainage have a good deal to do with the production of phthisis. Havilland has shown that in the case of females high dry chalky sites exposed to the free access of the east wind are accompanied by a high death-rate from phthisis, and that the same high death-rate obtains in the cold damp clayey valleys which these chalk ranges shelter. It is possible that people living

on high dry situations exposed to the east wind are prone to consumption not so much from the east wind itself as from the fact that, the air being cold, they close their doors and windows, and breathe and rebreathe their own poisoned and contaminated atmosphere. Havilland's statistics apply only to females, and it has not been shown that the same high mortality prevails amongst men, who, from the nature of their occupations, probably pass much more of their time in the open air.

Sir George Buchanan (Tenth Report of the Medical Officer of the Privy Council, 1868) has shown the existence of a pretty regular concomitancy in the fluctuations of the two conditions, from much phthisis with much wetness of the soil to little phthisis with little wetness of the soil. The following propositions have been established as the result of his researches :—

There is, broadly speaking, less phthisis among populations living on pervious soils than among populations living on impervious soils.

There is less phthisis among populations living



on high-lying pervious soils than among populations living on low-lying pervious soils.

There is less phthisis among populations living on sloping impervious soils than among populations living on flat impervious soils.

It is now generally accepted that wetness of the soil is a cause of phthisis to the population living upon it.

The influence of drainage has been shown by Buchanan in his table of towns, contrasting the connection between sanitary improvements and fluctuations of mortality from certain causes. The beneficial effect of drainage is strikingly shown in the case of Salisbury and Ely, the reduction in phthisis mortality being in the former place 49 per cent., and in the latter 47 per cent.

In connection with Salisbury, it may be mentioned that a strong claim has been urged on behalf of the late Mr. Middleton, of that city, to be considered the discoverer in England of the relation existing between dampness of the soil and consumption. Dr. Douglas Powell apparently discredits this claim, but Dr. W. D. Wilkes, of

Salisbury, advocates it very strongly, and even goes so far as to say that Dr. Buchanan was ignorant of the relationship existing between dampness of the soil and phthisis until his attention was called to it by Mr. Middleton.

Buchanan's observations were to some extent anticipated by Bowditch, of Boston, who in 1862 showed that in Massachusetts the dampness of the soil of any township or locality was intimately connected, probably in the relation of cause and effect, with the prevalence of consumption in that township or locality.

Finkelnburg, of Bonn, has shown that a high phthisis mortality is common in districts characterized by a mossy soil with stagnant or high-standing ground water. Altitude has a good deal to do with the reduction of mortality from phthisis, but it is the dryness of the soil which is the chief factor.

A phthisical patient who has the choice of a place of residence should select a house built on soil composed chiefly of gravel or sand. A clay soil is bad in every way, for water neither runs off

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nor runs through it, whilst the air is always moist or damp. Sandstone is not bad, but if the sand is mixed with much clay, or if clay underlies a shallow sand rock, it had better be avoided. Even when the soil is sand or gravel, care must be taken to see that inequalities in the ground have not been filled up with animal and vegetable rubbish collected from the nearest dust-heap. The house selected should not be close to a marsh or to stagnant water. Running water is usually harmless unless contaminated with sewage. An absolutely new house is nearly always damp, and should be avoided when there is a predisposition to phthisis.

### OVERCROWDING AND DEFECTIVE VENTILATION.

Overcrowding is undoubtedly responsible for many cases of phthisis. The respiration of impure air directly debilitates the vital powers, enfeebles the nervous system, depresses appetite, deranges the secretions, and leads to the retention

of effete matters in the blood. Dr. McCorman, in his valuable work on 'Consumption from Pre-breathed Air,' has shown that previously-inhaled air is one of the most potent factors in the production of phthisis. Dr. Henry Bennett says: 'With the fear of bacilli and contagion before the eyes, neither the patient nor his attendants will hesitate to ventilate sufficiently, and constantly renew the air breathed. *Free extreme ventilation is the most important means of preventing, and also of healing, pulmonary consumption.*'

Consumption and other tuberculous diseases are more common in large towns than in sparsely populated localities, and in towns it is the densely inhabited poorer districts which suffer most. Sufficient air-space for the inhabitants is more likely to be found in the houses of the well-to-do than in the dwellings of those to whom the question of the ability to find the rent is of more pressing importance than the sanitary state of the rooms. When many members of a family pursue their occupations in one small room, and when they have to cook and sleep in the same confined

space, there is no possibility of the room being properly aired. When, in addition, the bed and furniture are old and dirty, it is very difficult to keep things sweet and clean. The mother of the family probably has to work as well, and has very little time to perform the duties of a housewife.

Much might be done in the way of legislative enactments regulating the width of the streets, the height of the houses, and, above all, the preservation of open spaces. The establishment of public wash-houses has done much to minimize the frequency with which the washing and drying of clothes is carried on in small rooms. More might be done in this direction by the establishment of public work-rooms, where, on payment of a small fee, tailoring, bootmaking, and other similar employments might be followed. Overcrowding is not altogether confined to the poor. At many of our popular seaside resorts the cheaper lodging-houses are during the season disgracefully overcrowded, and the same assertion may be made with respect to some of the large London hotels. This, however, is hardly a

subject for legislative interference, as people who have money at command are perfectly able to look after their own comfort, and are rarely backward in expressing their views if they find reason for complaint.

In London the worst examples of overcrowding are met with, not at the East End, but on the large ducal estates, and in what were at one time fashionable streets. When the tide of fashion turns, the large houses are taken by lodging-house keepers, who make a living by letting apartments. After a time the street 'goes down,' and the rooms are let separately, each room, in all probability, being occupied by a family. The doors of communication between rooms on the same floor are plastered up to ensure privacy, and from that time through ventilation is an impossibility. When the occupant goes out he locks his door to prevent his things being stolen, so that the partial ventilation which might be ensured by an open window and an open door is lost. Moreover, the sanitary accommodation is bad and deficient, for the closets, which would have been

sufficient for one family, are not enough for a dozen or more families herded together in one house. The landlord has wealth and power on his side, and no appeal to him from impecunious tenants would be likely to receive much attention.

Some houses after a time seem to become infected with phthisis, and it is by no means improbable that the 'family house' is quite as important a factor in the production of the disease as the 'family predisposition.'

Many striking examples of the influence of impure air are noted in the Report of the Health of Towns Commission. The influence is most marked in prisons, in houses of correction, in workshops, and in schools. When vitiated air is breathed continuously, other injurious influences are usually at work. It usually means that the sufferer follows a sedentary occupation, and possibly works in a constrained position. In addition, he may be underfed, and it is a well-known fact that bad air makes people intemperate.

The effect of overcrowding in the production of phthisis is well exemplified in the army returns.

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At one time the mortality from phthisis in the army was enormously in excess of that amongst the civil population, and this excess was especially noticeable among the Foot Guards. There has been a marked diminution of this excessive mortality of late years. As the only condition which has been altered, and has undergone a decided change for the better, both at home and abroad, is the improvement in accommodation, there can be but little doubt that overcrowding in barrack life was to a great extent responsible. Sailors, in spite of constant out-door employment, often suffer from phthisis if overcrowded in their berths. That the disease is not the result of exposure is proved by the difference in mortality which prevails in different vessels. It has been proved that in Dundee the ratio of phthisis and of other diseases of a similar character increases with overcrowding, and the consequent foulness of the air. Thus, taking the ratio of houses of four rooms and upwards as 10, the other ratios are—for three rooms 17, for two rooms 20, and for one room 23. In many ill-ventilated and



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overcrowded prisons the mortality from consumption was enormous. It is possible that a restricted dietary, and the influence of a monotonous and depressing life, may have been contributing causes, but careful investigation has shown that overcrowding, combined with defective ventilation, were the primary factors. Observations on animals kept in confinement in zoological gardens point to the same conclusion. Monkeys in confinement suffer greatly from phthisis, and cows in close and ill-ventilated stables speedily fall victims to the disease. Horses which get plenty of exercise in the fresh air are rarely attacked.

Undoubtedly, one of the best ways of obviating the effects of overcrowding would be to absolutely condemn all back to back houses. Another good plan would be to forbid the erection of additional stories to houses situated in narrow streets. In London, where ground fetches a fancy price, the houses are creeping up higher and higher, so that the amount of daylight which reaches the rooms on the ground-floor becomes less and less.

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Another great mistake is building out an 'extra room' on the ground-floor, so as to cover what was originally a yard or open space. Streets should be open from end to end to admit a free current of air, but in many districts we find houses built right across the street, and at right angles to their length, so that residents in these streets are deprived of much of the air to which they are entitled. In many of the most highly-rented districts the ground is so overbuilt that only the upper rooms are really fit for habitation. A bedroom on the ground-floor is nearly always unhealthy, and the custom of allowing servants to sleep in the basement is one which cannot be too strongly condemned. In many large hotels and other places of business, the servants on night duty occupy during the day the rooms which have been slept in by their fellow-servants who are on day duty. When this is the case there can be no proper ventilation, and cleanliness must be at a discount. It is to be trusted that these antiquated and pernicious customs will soon disappear. There can be no health unless the rooms are

thoroughly ventilated by means of a current of air from open windows. No one would think of taking a house which is all front, and has no back windows.

#### THE INFLUENCE OF LIGHT.

There is good evidence to show that light, and especially direct sunlight, exercises a beneficial influence in maintaining the general standard of health. The Italians have a proverb to the effect that where the sun does not enter the doctor does, whilst amongst the Indians there is a saying that 'He who plants a tree in the front of his dwelling begins to dig his own grave.' In connection with this subject, reference may be made to a paper 'On the Influence of Light upon Protoplasm,' published in the Proceedings of the Royal Society, by Dr. Arthur Downes, now of the Local Government Board, and Mr. Thomas P. Blunt. In this valuable and suggestive paper it is shown by a series of elaborate experiments that light is inimical to, and under favourable circumstances

may wholly prevent, the development of bacteria and organisms associated with putrefaction and decay. An attempt was made to ascertain with what part of the spectrum this property of light was associated, and the conclusion arrived at was that it depended chiefly on the blue and violet rays.

Practical men have long recognised the value of direct sunlight in the treatment of consumption, especially in the early stages. Dr. Pollock refers pointedly to the value of sunlight as a therapeutic agent, and mentions the curious observation that a freckled child is rarely consumptive. He says that there is not only mental invigoration in sunlight, but there are vital agents assisted and possibly developed by it. Dr. Hermann Weber bears equally emphatic testimony as to the value of sunlight, and suggests that, when possible, patients when suffering from consumption should be placed on a terrace or balcony sheltered from cold winds, but exposed for many hours during the day to the full direct rays of the sun.

It is important in the selection of a place of residence for a person suffering from lung trouble

that the aspect should be due south. The best arrangement is to have the sitting-room on the ground-floor, and the bedroom immediately over it. When from necessity both rooms are on the same floor, the sitting-room should face the south, and the rooms should communicate by folding doors, which should be left open during the day, to permit of the sun shining through them into the back room. Reflected sunlight is not without a beneficial influence, and when rooms on the same floor face east and west, it is quite easy to arrange half a dozen small mirrors so that during many hours of the day both rooms get the benefit of the sunlight. I have for many years adopted this simple plan with advantage. If the mirrors are objected to on the ground that they are not sufficiently ornamental, they can be painted with flowers, should that special form of art excite the fancy of the occupants of the rooms. The typical housewife is very fond of pulling down the window-blinds when the sun shines to save the carpet from fading, but this is paltry economy, which should not be tolerated for one moment.

Attention may be called to the interesting paper by Mr. Siemens, 'On the Influence of Electric Light on Vegetation.' He showed that plants progressed much more readily, and attained a much higher degree of development, when subjected to the influence of sunlight by day and of electric light by night, than when exposed to the action of sunlight only. It is true that he experimented with an electric light of 1,400 candles driven by a three-horse power Otto gas-engine, but for indoor work a light of much less intensity would suffice. It is conceivable that anæmic consumptives would make better progress in a house well lighted with electricity, especially in London during the winter months, when the sun is rarely seen and the hours of daylight are short. Electricity as a lighting agent can now be obtained at so small a cost that the experiment is worth trying.

OCCUPATION AS A PREDISPOSING CAUSE OF  
PHTHISIS.

The effect of certain industries, and especially of those attended with the inhalation of dust, in producing bronchitis, asthma, fibroid pneumonia, and phthisis has long been recognised. Stonemasons, potters, tool-grinders, cotton operators, lace workers, and those engaged in flax industries, suffer severely, and out of proportion to the rest of the population, from diseases of the chest. Amongst the most deadly of the dust-producing occupations are those followed by file-makers, earthenware manufacturers, and Cornish miners. In all three trades the men work in a close atmosphere which is thick with a dust which not only is a mechanical irritant, but is also a poison. The poison is the same in all three cases, and consists of lead in a minute state of subdivision. The file-cutters strike their files on a lead cushion, the potters use a lead glaze, and the Cornish miners work in the ore. Of men who follow

dusty occupations colliers suffer least, a somewhat remarkable fact, seeing that we have to take into consideration not only the influence of dust, but the absence of light, the exposure to dripping water, and the fouling of the air from the emanations of hundreds of men and horses who are collected together in the restricted space underground. The probable explanation of this comparative immunity is that the general dampness of the atmosphere prevents the dust from flying about.

The inhalation of dust induces as a rule a malady bearing a strong similitude to tubercular phthisis, although not of necessity tubercular in nature. For example, in many cases of potter's consumption from dust the bacilli have been sought in vain. In grinder's phthisis, commonly known as 'grinder's rot,' there is no necessary connection with tubercle, although the latter often complicates it. The lung disease produced by dust is as a rule unaccompanied by fever, the pulse is not accelerated, and diarrhœa is not a common symptom.



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Many artisans who are in the habit of inhaling dust are also exposed simultaneously to other influences which act injuriously. For example, flax operators who work at cording carry on their work in close, ill-ventilated rooms, the temperature of which is usually 90°, and may be as high as 120°; their average duration of life is short, and a girl who begins this work at seventeen or eighteen usually shows signs of breaking-up by the time she is thirty. That the dust is an important factor in producing lung disease is shown by the fact that potters suffer just in proportion to the amount of dust given off in their respective branches of work. The fatality from dry-grinding varies much in different branches of the cutler's business. Scissor-grinding heads the list, and it is succeeded by fork, razor, and penknife grinding. Table-knife, saw-file, and scythe grinding is done wet, and is much less injurious. The degree to which workers in stone become affected varies with the quality of the stone, whether it is worked wet or dry, and whether in the open air or in closed sheds.

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That the adoption of precautionary measures and the introduction of improved machinery are capable of mitigating these serious evils is conclusively demonstrated by the improvement in health in the case of those engaged in silk manufacture. At one time the silk towns were notorious for their high rate of mortality from consumption, but of late, thanks to the introduction of improved methods, the mortality has materially decreased. In fact in some instances—notably in the case of Leek—the mortality from consumption is now not greater than in many other towns. In former days Sheffield grinders accepted their lot as inevitable, and, curiously enough, almost always brought up their children to their own dangerous calling. The Factory Act has done much to remedy this unfortunate state of affairs, partly by prohibiting the employment of very young childrer, and partly by enforcing the use of fans to carry off the dust. In needle-grinding the introduction of extraction tubes connected with each grinder has been productive of much benefit. Another good and simple plan

is to cover the stone with a wet cloth, leaving only just so much working surface as is actually required in the process of grinding. One of the great difficulties in the way of introducing better and healthier methods arises from the operatives themselves, who seem to attach very little value to their lives. A striking example of this is seen in the case of the pearl-button trade. The dust given off in the manufacture of mother-of-pearl resembles that given off from lime, both chemically and in its injurious effects. And yet only a few years ago the association of the workers in the trade passed a by-law forbidding the introduction of improved processes, the men preferring a short life with high wages to a longer life with a smaller income. It is very much easier to enforce the observance of precautionary measures in large factories than it is when the work is carried on by a number of small people in cottage workshops. The poorer operatives have no capital, and are incapable of providing improved appliances even of the simplest description. The principle of guarding the working man against avoidable

risk is not only humane, but is also directly conservative of the sum total of national wealth. The taxpayer has to support the human wreckage from the disastrous dust trades in infirmaries, asylums, and other refuges to which the workman is driven when he is no longer able to work. It has been urged with a certain amount of justice and reason that the capitalist who has reaped the greater portion of the pecuniary benefit should be compelled to support the people who have become incapacitated in his service, and that the burden should not be allowed to fall on the community at large.

I have been at some pains to ascertain the occupations followed by 1,000 men suffering from well-marked phthisis who have been under my care in hospital practice.

I had thought of treating 1,000 women in the same way, but I soon found that they made statements which were so utterly unreliable that they were useless for statistical purposes. Many of them insisted that they followed no occupation, whilst others apparently followed such a variety

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of occupations, and eked out their modes of making a livelihood in such a variety of questionable ways, that there was no alternative but to reject them.

The 1,000 men represented 128 different occupations. It may be as well to mention that no record was attempted of lads and boys at school, and that all the patients were adults. The statistics refer to a hospital in London, and that accounts for the absence of potters, cotton operatives, lace workers, silk manufacturers, and possibly of others whose occupations and industries are confined to certain districts. Some trades, although common in London, were poorly represented, and I have given the statistics of those callings which suffered most.

The following are the chief items in the list :

	Per 1,000.		Per 1,000.
Clerks - - -	70	Carpenters - - -	36
Porters - - -	68	Tailors - - -	32
Cabinet-makers - -	56	Printers - - -	30
Bootmakers - - -	44	Bookbinders - - -	24
Labourers - - -	44	Wood-turners - - -	24
Shop-assistants - -	38		

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It is by no means surprising to find that clerks are the chief sufferers. They follow a sedentary occupation, and many of them are compelled to work in close, ill-ventilated offices, lighted from morning to night by gas, and into which the sun never shines. Moreover, they have to keep up a 'respectable' appearance on a wage which is less than that of an artisan. They wear a black coat and a tall hat, both of which interfere materially with outdoor exercise. They get few holidays, and their only recreation is in backing horses.

It is somewhat surprising to find that porters run the clerks so hard, but I fancy the numbers are largely augmented by the fish-porters, who are constantly exposed to wet, and have to work in all weathers.

Cabinet-makers use sandpaper largely in their work, and this evidently has a good deal to do with their susceptibility to lung disease.

Labourers have a hard life, and are much exposed to cold and wet.

Why bootmakers should suffer more than tailors I did not know. The tailor certainly works

in a constrained position, whilst the bootmaker in hammering in his brads get a very fair amount of muscular exercise.

Shop-assistants lead a fairly active life, but their hours of work are long, and the shops are often badly ventilated. Possibly the effort to be always civil and attentive may act on them prejudiciously. Theirs is what may fairly be called a 'trying' occupation, especially if the majority of their customers are ladies.

Printers suffer most if they are engaged in bronze printing, in which a good deal of dust is given off.

Wood-turners and wood-carvers suffer from the effects of dust, and the same applies to carpenters. Carpenters who work on 'hard wood' suffer much more than those who confine their attention to 'soft woods.'

In the whole of my 1,000 cases the army was not represented. That is probably accounted for by the fact that soldiers are provided with medical attendance, and rarely come to the hospitals. The old army man who has received his discharge

usually follows some other occupation, and is entered under some other heading.

There was only one sailor, but this may possibly be accounted for on the supposition that sailors frequent certain hospitals near the docks and the various places of debarkation.

People who drive seem to be a fairly healthy lot, for there were only 18 carmen, 12 cabmen, 2 omnibus-drivers, and 2 coachmen. The police force seems healthy, for there were only 8 police constables and 2 warders. There was only one solitary representative of the detective force.

Commission agents, canvassers, hawkers, and general dealers were few in number. There were 6 school-board visitors, and there was 1 broker.

The occupations connected with drink were not represented to any large extent. There were 12 barmen, 8 waiters, and 2 butlers, besides 4 coopers, 4 cellarmen, and 1 wine-examiner. There were 4 pianoforte tuners, but it was ascertained that in addition they were 'musicians' who added to their incomes by playing either in the streets or at the doors of public-houses.



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Butchers and gardeners are supposed to display a marked immunity from phthisis, and there were only two examples of each class.

There is an obvious fallacy in these statistics, and in the conclusions drawn from them, as we do not know the relative numbers of each class represented. The census statistics are of no help to us, because trades and occupations are curiously localized, and we find little communities of people following the same calling scattered about in different parts of London. It seemed to me that the only chance of solving the problem was to take another thousand patients attending the same hospital and during the same period, but excluding the phthisical cases. This I have done, and arrived at the following figures, the occupations being arranged in the same order as in the previous table :

	Per 1,000.		Per 1,000.
Clerks - - -	45	Carpenters - - -	30
Porters - - -	50	Tailors - - -	14
Cabinet-makers - - -	42	Printers - - -	27
Bootmakers - - -	45	Bookbinders - - -	21
Labourers - - -	74	Wood-turners - - -	20
Shop-assistants - - -	20		

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Now, if we combine these two classes, and note the number of phthysical patients above or below the average, we arrive at the following figures :

	Per 1,000.		Per 1,000.
Clerks - - -	+ 12'5	Carpenters - - -	+ 3
Porters - - -	+ 9	Tailors - - -	+ 9
Cabinet-makers - -	+ 7	Printers - - -	+ 1'5
Bootmakers - - -	- 0'5	Bookbinders - - -	+ 1'5
Labourers - - -	- 15	Wood-turners - - -	+ 3
Shop-assistants - -	+ 9		

This is probably a fairer conclusion, although the results do not differ very materially from those of the first table. The clerks still occupy the first place, but the labourers come out much better than was anticipated. It is seen from this method of computation that bootmakers in reality suffer less from phthisis than do tailors.

It would be absurd to attach too much importance to statistics of this kind, but in a rough way they are suggestive, and throw some light on the causes which predispose to phthisis.

Much useful information respecting the influence of occupation in relation to public health

will be found in the Milroy Lectures delivered before the Royal College of Physicians in 1889.

CONFINEMENT AND MONOTONY AS POTENT  
FACTORS.

The influence of confinement combined with depressing influences is a well-recognised factor in the production of phthisis. This combination of circumstances is met with alike in prisons and in convents, and the mortality amongst the inmates of religious houses from consumption is well known.

In 1880 I gave an account in the *Practitioner* of certain facts which were communicated to me by Dr. Henry von Dessauer, of Valparaiso, respecting the frequent occurrence of hæmoptysis amongst the inmates of a large convent school with which he was connected. Since then many facts bearing on this point have been recorded by various observers.

A few years ago there existed in Paris a nunnery

of a new foundation which had failed to obtain from the ecclesiastical authorities anything beyond a temporary tolerance on account of the severity of its rules. The alimentary regimen of the inmates was sufficient, but the spirit of the rules of the establishment, directing the mind to the most terrible rather than to the consoling dogmas of religion, produced somewhat unexpected effects. At the end of two months' sojourn in the house, we are told that the menses became suppressed, and that in less than a year in the majority of cases symptoms of consumption appeared. As the nuns had not taken the usual vows, some of them were advised to leave, and all who did so recovered. But during the ten years that followed the opening of the establishment, the numbers were renewed twice, with the exception of the superior, the gatekeeper, the sisters who had care of the garden, of the kitchen and the infirmary, and of such as had more frequent intercourse with the city, and consequently greater distraction. The rest died of consumption.

Dr. Heron, in his 'Evidences of the Communicability of Consumption,' gives some interesting statistics obtained for him by Cornet from the Prussian Minister of Public Worship. They deal with the rate of mortality amongst the Catholic nursing orders in Prussia. The members of this association are bound by a vow to remain for life in their respective orders, and neither when ill nor for any other reason are they ever permitted to abandon convent life. These individuals, if they perform no other useful function, are of value as affording reliable health statistics, as each inmate can be traced from the date of admission until final closure of the account by death. These communities represent a yearly average of 4,028 persons, distributed amongst thirty-eight convents. The majority of the inmates die of consumption. The death-rate of people outside these religious establishments from consumption is from one-seventh to one-fifth of all deaths; but amongst the nursing community it is nearly two-thirds of all deaths, no less than 62·88 per cent. dying of tubercular disease. In

two houses tubercle was the sole cause of death, every individual succumbing to the disease. The average age at death of the inmates of these asylums was only  $36\frac{1}{4}$  years, and yet these people were all healthy at the time of admission, for by the rules every candidate had to produce a certificate of perfect physical health. If a similar condition relating to mental health were enforced there would, in the face of these statistics, be a considerable falling off in the number of candidates admitted. The average duration of life of a person who enters one of these establishments at the age of 20 is 16 years. These people are not badly fed; they die from the effects of confinement combined with a dreary, monotonous, depressing life. Statistics concerning similar establishments in England and Ireland are not easily attainable, but from personal observation I know that in some nunneries the inmates rarely enjoy good health, and that consumption is the disease from which they most commonly suffer. Many of these women have lost all interest in the world, they are helpless

and incapable, and after a short time so utterly lose their will-power and become subservient to others that they have no desire to break their bonds and lead a better and purer life, even if they had the opportunity of doing so.

#### HEREDITARY INFLUENCE.

One of the most important factors in the production of phthisis is hereditary predisposition. It is necessary to draw a distinction between hereditary and family predisposition, the former being limited to direct descent, and the latter including cases in the collateral branches. Hereditary predisposition occurs in at least 25 per cent. of the cases, whilst family predisposition has been noted in 48 per cent. Dr. J. E. Squire, as the result of an examination of a thousand phthisical patients, found that there was a history of consumption in one or both parents in 32·5 per cent. of the cases. This influence seemed to be more marked in the case of women, for the percentage amongst the female patients was

37·87, whilst amongst the male patients it was 28·97.

The question of the sexual transmission of disease is one of much interest, and the view now generally accepted is that the father commonly transmits to sons and the mother to daughters. When both parents are tubercular the children rarely escape: the exact figures are 39·45 per cent., excluding those children which die in infancy. It is probable that tuberculosis is never directly transmitted from mother to child, but that the milk of a tuberculous mother contains the lethal agent which finds a congenial soil in the debilitated offspring.

When it is said that phthisis is hereditary, it is not meant that the disease itself is actually conveyed from parent to child, but that what is transmitted is a predisposition, or, in other words, an inherited quality of soil which is favourable to the development of tuberculosis, but can be fertilized only by the specific spores of that disease. This inherited fertility of the soil may be intensified in many ways, and the intensifying causes are to be



found in the occupations of life, in the privations of life, and in what Pollock calls the errors of life. 'To this class,' he says, 'belong all excesses which waste vital powers, undue carefulness and anxiety, over-watching, sexual excesses, the excited race after wealth or distinction, and the ineffectual struggle against poverty; the over-nursed in close and luxurious chambers, and the student outstepping his powers on a short Alpine holiday; the sorely-taxed governess toiling all day and sitting up half the night to enjoy the luxury of solitude and converse with books and absent friends; the under-dressed lady undergoing in ill-ventilated rooms the dangerous excitement of the ball; all these and many others are labouring thoughtlessly to prepare the field in which the seeds of death may be sown and become productive or not as other agencies may determine.'

The view is now generally held that the phthisical should not marry, and, moreover, that those strongly predisposed by family inheritance of disease should not marry. So long as con-

sumptives marry, and transmit a tendency to the same disease, which is not escaped by more than one out of every three of their descendants, so long shall we have the same malady confronting us in successive generations. It is well known that phthisical patients are nearly always prolific. Instances are recorded of as many as seventeen brothers and sisters dying of consumption. If consumptive people must marry, they should at all events take reasonable precautions, and not bring into the world a crowd of children who can be nothing but a source of trouble or anxiety to their parents and a misery to themselves.

That business men fully appreciate the importance of any hereditary taint of phthisis may be gathered from the scale of charges adopted by life assurance offices. When a candidate presents himself for examination for life insurance, ten years are added to his life—to use the technical expression—if one of his parents died of consumption, even should he himself be perfectly healthy. If both parents died of phthisis, it is customary to decline the life unless the applicant

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is over forty years of age. If one parent and one quarter of the total number of brothers and sisters of the applicant died of phthisis, the candidate, if under thirty-five years of age, is charged double rates; whilst if one parent and more than a fourth of the children died of consumption the life is declined. Dr. Reginald Thompson maintains that 'no applicant having a distinct family history should be accepted until he has reached the age of twenty-five.' There cannot be a better proof of the importance attached to this family taint from a commercial point of view.

It is quite possible that many cases of consumption which are supposed to be hereditary are in reality due to other causes, one of the chief in all probability being contagion. If, for example, a parent suffers from advanced phthisis, and lives in intimate contact with the children, they are not unlikely to contract it directly from him, just as they might do from a stranger. The probability of their becoming phthisical is, of course, materially increased by the fact of their

inheriting a bodily condition which is favourable to the propagation of the bacillus. In other cases the children of phthisical people contract the disease from breathing the air of rooms infected with the disease. If disinfection were carried out systematically, the percentage of so-called hereditary cases of consumption would undoubtedly be materially reduced.

Dr. Squire maintains that there is no hereditary predisposition to phthisis as such, and that what is transmitted is a certain frailty of tissue, a vulnerable condition of health, a certain defective power of resistance to morbid influences which leaves the victim an easy prey not only to this particular disease, but to many other diseases. It has been suggested that the form of tissue weakness which, in early life, leads persons to contract phthisis, in later life renders them peculiarly liable to cancer.

## THE CURE OF CONSUMPTION.

Having described at some length the conditions which predispose to the occurrence of consumption, the next step is to consider what means are at our disposal to remedy or alleviate this unfortunate state of affairs. It will be readily admitted that we have no specific remedy for phthisis. We know of no drug which bears the same relationship to consumption that quinine does to ague, that mercury and the iodides do to syphilis, that colchicum does to gout, or that salicylate of soda does to acute rheumatism. No one wishes for a moment to underrate the importance of cod-liver oil, extract of malt, the hypophosphites, or even arsenic and phosphorus as palliative agents, and no one denies that they have done a great deal to prolong the lives of sufferers from tubercular disease, but they are not curative. They are of great use, but they are not capable of stamping out the enormous mortality from phthisis to which reference has been made. Koch's tuberculin, although of inestimable value

as a diagnostic agent, has passed out of the range of practical therapeutics. Climatological treatment has done much, but it is not everyone who can afford to winter year after year in some favoured climate. When a poor man presents himself for treatment, it is very little satisfaction to him to be told that his life might be prolonged if he could pass his winters at Davos or on the Riviera.

In the vast majority of cases we can only alleviate symptoms, and are practically unable to cope with the large mass of patients who have become consumptive and wish to be cured. And yet phthisis is decidedly a manageable disease, if only all the conditions favourable to its arrest could be secured. Pathologists report, as the result of post-mortem examinations, that from 25 to 30 per cent. of persons who have died from diseases other than phthisis present indications of arrested lung mischief. At the Morgue in Paris, Vibert examined the bodies of 131 persons who had died as the result of violence, and in 17 instances found distinct evidence of the cure

of consumption. Loomis, of New York, met with 71 cases of arrested disease in 763 autopsies.

As we have practically no available means of curing more than a comparatively small percentage of our cases of phthisis, our only hope, for the present at all events, is to adopt such measures as are at our disposal to prevent its propagation. The fact that consumption is to some extent curable, and that the majority of patients succumb to it only after repeated attacks, although in one sense a source of satisfaction, materially increases our responsibility in the matter from the constant presence amongst us of a large number of quiescent or arrested cases and of susceptible individuals whom it is especially necessary to protect as far as possible from its invasion.

#### LEGISLATIVE INTERFERENCE.

If efficient measures are to be taken for stamping out consumption, legislative action of some kind, and probably in various forms, must be invoked.

The legal mind is always guided by precedent, and fortunately legislation has already done much to protect the community from disease.

In London, and in all towns of any importance, the Notification Act is in force, and a doctor attending a case of infectious disease is compelled under a penalty to give official intimation of the fact to the Medical Officer of Health for the district, in order that adequate steps may be taken to prevent the spread of the disease. The notification of infectious diseases is utilized in two ways, for whilst there is a penalty for failing to report the existence of infectious complaints, the medical attendant is encouraged to perform this duty by a system of small rewards. The term 'infectious disease' includes small-pox, cholera, diphtheria, erysipelas, scarlet fever, typhus and typhoid fevers, and some other diseases, and the local authority has power to extend the definition either temporarily or permanently. Consumption is not contagious in the same sense that scarlet fever and small-pox and diphtheria are contagious, although there is no doubt that, under certain circumstances,



it may be communicated. Many authorities urge that phthisis should be included in the list of notifiable diseases, and undoubtedly it would be a good thing if this were done. The onset of consumption is as a rule gradual, and it hardly appeals to the popular mind in the same way as does, say, an attack of small-pox. If a man gets small-pox he is acutely ill, and has to give up his work and seek assistance, medical and otherwise. In the case of phthisis he is not confined to his bed, and manages to get about more or less. He is slow to recognise the nature of his complaint, and probably tries all kinds of popular remedies before seeking the advice of a doctor. Moreover, people are afraid of fevers, but a case of consumption does not alarm them in the same way, and they see no danger from it. It might be advisable to encourage people to give information to the medical officer respecting the existence of the complaint, but forcible legislation is a mistake unless backed up by popular opinion. In these technical matters it is best to progress slowly, and it must be admitted that at the present

moment the feeling in favour of adding consumption to the list of notifiable diseases is not sufficiently pronounced to make it expedient to enforce it.

The registrar of the district might be instructed that when a death from phthisis occurs he should communicate with the sanitary officer in order that steps might be taken to disinfect the room which had been occupied by the patient. Dr. H. Cooper Pattin, the Medical Officer of Health for the city of Norwich, in his report for 1893, offers to disinfect rooms, etc., after the death or removal of a tuberculous inmate, free of charge, but he informs me that so far very few people have availed themselves of the opportunity afforded them. It is probable that the idea is new to them, and that they hardly appreciate the importance of this step. Dr. Pattin's example will probably be followed by other medical officers of health, so that as time goes on the public mind will become familiarized with the necessity for adopting so simple a precautionary measure. This, with the distribution of literature bearing on the subject of

the contagiousness of phthisis, must have a beneficial effect.

If we wish for other examples of judicious legislative enactments, we find them in the Acts relating to vaccination and in the Inebriates Act. Legislation has done much: the only question is if more could not be accomplished in the same direction.

#### PRACTICAL POINTS.

If any serious attempt is to be made to lessen the mortality from consumption, there must be both combined, or legislative, action and personal effort. In the first category we aim at—

1. The ultimate inclusion—when public opinion is ripe for that step—of consumption in the list of notifiable diseases.

2. Public and official announcement of the fact that, in the event of a person having died of consumption, the rooms occupied by him will be disinfected by the sanitary authorities free of charge. The facilities for disinfection should

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extend to any dwelling which has been vacated by a consumptive person, and should be enforced in the case of hotels and lodgings at health resorts frequented by sufferers from chest diseases.

3. The passing of an Act making it illegal to let any house or room in which any person within two months has suffered from consumption without having had it properly disinfected.

4. To make it an offence punishable by fine or imprisonment for any person letting a house or room to wilfully conceal or deny that there has been consumption in the house.

5. To call the attention of shipping agents to the fact that there is danger to a healthy person in occupying the same cabin with a consumptive, especially on long voyages, and when, from the inclemency of the weather, the passengers are not much on deck.

6. To make it compulsory for a consumptive person taking a long voyage by sea to notify the nature of his complaint before starting.

7. To call the attention of railway companies on lines connected with well-known health resorts

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for consumptives to the necessity for having the sleeping carriages carefully cleaned with some disinfecting solution, and above all thoroughly aired.

8. The removal of hospitals for consumption from London and other large towns to some convenient and open suburb. The out-patient department might, for convenience, be retained in town, but there should be no in-patients. Hospital omnibuses might ply from certain fixed points to the hospital and back, and should not be available for the general public.

9. The exercise of greater care in the inspection of carcases intended for food, and the compulsory rejection of those exhibiting indications of the tubercular disease.

10. The rejection as an article of food of the milk of tubercular cows.

11. The inspection of herds by paid officials, with the view of detecting tubercular disease, and isolating or destroying infected animals.

12. The prevention of overcrowding amongst animals intended for consumption as food.

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13. The prevention of overcrowding amongst people, by regulating the amount of cubic space allotted to each person in common lodging-houses, workshops, etc.

14. The extension of washhouses, and the establishment of places where certain trades, such as tailoring and bootmaking, could be carried on by the payment of a small fee.

15. Back-to-back houses should be condemned, and the height of houses in cities should be in proportion to the width of the streets.

16. Blind alleys should be opened out, and the custom of building houses at right angles to the length of the streets should be forbidden.

17. Dusty occupations should be strictly regulated, so as to minimize the danger to those who are compelled to follow them.

18. Convents, and other religious communities, should be periodically inspected by some independent authority, with the view of ascertaining the general condition of the health of the inmates, and suggesting such sanitary and other measures as may seem necessary.

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In the second category the following points are of importance :—

1. No one should consent to sleep in the same room with a person suffering from advanced phthisis, especially when the expectoration is abundant.

2. The temperature of the room occupied by a consumptive person should not be too high, especially when he is confined to bed, and efficient ventilation should be secured, preferably by means of open windows.

3. The patient should expectorate into a spittoon containing the Local Government Board solution or some other equally good disinfectant. The expectorated matter should be destroyed by mixing it with fine coal and burning it in the fire.

4. The pocket-handkerchiefs used by the patient should be thrown into a bucket containing the 'L.G.B.' solution, and should be scalded before being sent to the wash. Instead of the ordinary handkerchief, a paper substitute or pieces of rag may be used, and these should be burnt.

5. It should be remembered that the risk of conveying the disease from the sick husband to the healthy wife who nurses him is great.

6. The wife who nurses a husband suffering from consumption should get out in the fresh air as much as possible, and should do all in her power to maintain the condition of her own health.

7. Wind instruments and other similar articles which have been used by a consumptive person had better be destroyed when no longer required by him, and should certainly not be used by healthy people without previous disinfection.

8. Never travel on board ship in the same cabin with a consumptive person. Apply to the surgeon for another berth, or for an order to have the sick person removed to the ship's hospital.

9. Food should be well cooked, not only superficially, but throughout.

10. In the case of tubercular children, or of people predisposed to phthisis, it is a good plan to boil all milk previous to use.

11. People predisposed to phthisis should select



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as a place of residence a house on a gravel soil, preferably on a slope and facing south.

12. Those predisposed to phthisis should select non-sedentary occupations, and should be encouraged to spend as much time as possible in the open air, and above all in direct sunlight.

13. People should be taught to value the importance of amusements of all kinds, and to recognise the danger of leading monotonous and depressing lives.

14. The children of phthisical parents should devote much time to athletic exercises, and should not be allowed to follow sedentary occupations.

15. They should be encouraged to migrate, and not to live in the house which their parents occupied.

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